NEARSHORE WAVES IN THE RHONE DELTA. IMPLICATIONS FOR ALONGSHORE DYNAMICS

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ABSTRACT

The Rhone Delta has seen a reversal of its growing behaviour during the last century. It is assumed to be caused by the trend towards a warmer climate which increases the sea-level and a diminution of the sediment input carried by the Rhone as a consequence of reforestation in its catchment basin coupled with damming of its flood-prone affluents. The previously existing equilibrium in the system has been broken as the erosive agents have not stopped working. Amongst them, sea waves are the most important factor driving sediment transport and with it ruling the changes in the shoreline.

Focusing on a study area dominated by an accretive spit in an otherwise straight E-W sandy coast, the longshore dynamics have been addressed. The aims of this study are twofold. First, to characterise the wave climate at three different locations of the study area (offshore boundary, nearshore and on the verge of the breaker zone) based exclusively on a one-year data record from a buoy in front of the spit coupled with bathymetrical data. Secondly, to determine the waves' effects on the longshore sediment transport in the coast.

First a trimming of the original wave data has been performed. Afterwards, a simple backward "refraction + shoaling" propagation has provided tentative values for the offshore climate. This has been accurately determined using a forward propagation cycle involving the use of SWAN, whose output at the buoy is compared to the reference record. When the divergences amongst the two have shrinked to tolerable levels, SWAN's input has been assumed to be the offshore climate and its nearshore output has been accepted. Results all along the coast following a -5 m bottom isoline have been found. From there, new forward "refraction + shoaling" propagations have brought the waves to the verge of the breaker zone, where a new set of wave climates has been established. The effects on them caused by the coast's morphology have been studied.

Two formulae have been applied to determine the sediment transport due to the wave attack on the coast: those by Kamphuis and CERC. The former demands data regarding several beach parameters, amongst others, the grain size. However, these were not available but for its easternmost end, and therefore, the main study had to be performed in a unigrain fashion. The latter relies on a local calibration of its constant K in order to yield satisfactory results. A value previously obtained in the same delta was available and has been applied.

It has been found that the offshore wave climate is similar to the reference one at the buoy, albeit with an increase in wave height and scattering of the main directions.

Both nearshore and breaking zone wave climates show a strong sheltering effect in the gulf area, especially in the lee side of the spit. In some breaker zone locations the different wave directions merge into a single group fairly perpendicular to the coast.

CERC and Kamphuis formulations yield qualitatively similar but quantitatively divergent results, with Kamphuis overtly underestimating both longshore transport and the erosive/accretive dynamics. In the latter, the differences between taking into account or not the variation of the grain size along the coast are minimal, though the scarcity of data impossibilities generalisations.

Accretion is concentrated in the lee side of the spit, fed by erosion along nearby Faraman and (western) Beaduc beaches. A significant amount of sediment leaves the study area through its western end, where erosion is also present. These results are on line with those found in literature.